

March 11, 1998

The Honorable Ernest J. Moniz
Under Secretary of Energy
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Dear Dr. Moniz:

Defense Nuclear Facilities Safety Board (Board) staff review teams visited the Savannah River Site on January 6–8 and 12–16, 1998, and February 5–7, 1998, to review preparations to resume first-cycle solvent extraction operations at H-Canyon. H-Canyon plays a vital role in nuclear materials stabilization at the Savannah River Site, and it is important that the facility and its personnel be thoroughly prepared before beginning this expanded operation.

The reviews conducted by the Board's staff identified a number of issues that need to be resolved before first-cycle solvent extraction operations begin. Discussions between the staff and Savannah River Site personnel have led to resolution of several issues satisfactorily. Several other matters, particularly those associated with controls preventing hydrogen deflagrations in process vessels, criticality controls, and the programmable logic controller used to implement limits established in the Technical Safety Requirements and Double Contingency Analysis, merit further consideration. The Board believes these issues can be addressed and resolved without affecting the current schedule for commencing first-cycle solvent extraction operations.

The enclosed reports provide a synopsis of the observations resulting from the staff reviews and are forwarded for your consideration. If you need additional information, please do not hesitate to contact me.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark Whitaker

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

DNFSB Staff Issue Report

February 17, 1998

MEMORANDUM FOR: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: R. T. Davis

SUBJECT: Preparations for H-Canyon First-Cycle Operations

This memorandum documents an issue reviewed by a member of the staff of the Defense Nuclear Facilities Safety Board (Board) R. T. Davis, with the assistance of outside expert R. West. Preparations for H-Canyon first-cycle solvent extraction operations at the Savannah River Site (SRS) were reviewed on January 12–16, 1998, and February 5–7, 1998.

Westinghouse Savannah River Company (WSRC), which manages and operates SRS for the Department of Energy (DOE), will use H-Canyon to stabilize approximately 1900 deteriorating irradiated fuel assemblies during a 3-year campaign. H-Canyon is being restarted in three phases. The first phase, dissolving and head-end operations, began in July 1997. The second phase, first-cycle solvent extraction operations and associated solvent recovery and waste-handling activities, is scheduled to restart on May 4, 1998. The final phase, second product (neptunium) and uranium cycles, is scheduled to restart in late 1998.

WSRC declared readiness to proceed with H-Canyon first-cycle operations and DOE began its Readiness Assessment (RA) on January 26, 1998, and February 2, 1998, respectively. Because of equipment and configuration problems, the RA was suspended on February 5, 1998, at the request of WSRC. WSRC developed a corrective action plan and expects the DOE RA to resume on March 30, 1998, with hot operations to begin on May 4, 1998.

The Board's staff reviewed the implementation of controls identified in the H-Canyon authorization basis documents and facility readiness for first-cycle operations. The principal issues identified by the staff are summarized below.

Implementation of Controls. WSRC installed a new control system that uses a programmable logic controller (PLC) for automatic control of first-cycle operations. This PLC also functions as a safety-significant interlock to shut down first-cycle operations based on indications from a neutron monitor and uranium analyzer. The two Double Contingency Analysis (DCA) controls to prevent a criticality in the mixer-settler are control of stream parameters (using the PLC in some cases) and the PLC interlock. Because both contingencies use the PLC, a single-point or common-mode failure in the PLC could disable both DCA controls. Additionally, the PLC does not appear to meet process industry requirements for design of a safety

instrumented system, as described in American National Standards Institute (ANSI)/Instrument Society of America (ISA) standard ISA-S84.01-1996, *Application of Safety Instrumented Systems for the Process Industries*. For example, the H-Canyon PLC system does not meet requirements for separation of the basic process control functions from the safety instrumented system functions and vendor identification of failure modes and frequencies.

Facility Readiness. Equipment failures and control of process stream parameters appear to be significant problems at H-Canyon. Several equipment failures have occurred during preparations for first-cycle operations (e.g., mixer-settler motor failures, neutron monitor spurious trips, uranium analyzer failure). Additionally, because of material problems, the operators have been unable to maintain some process stream parameters within the required operating range. Several attempts to conduct extended cold-run operations could not be completed because of equipment problems. WSRC corrected most of these problems and completed a 24-hour cold run before declaring readiness. However, some stream parameters were not maintained within the operating range during this 24-hour run. Failure to maintain these parameters during normal operations would have required the process to be shut down because these parameters may affect both DCA controls and process efficiency.

H-Canyon engineers initiated a troubleshooting procedure in October 1997 for modifying the PLC software control algorithms to achieve acceptable automatic control of the mixer-settler stream parameters. Once the troubleshooting procedure has been completed and the proposed PLC software changes have been identified, the software changes will need to be verified and tested in accordance with the software quality assurance plan. Operator training and procedure modifications would then be performed as required. However, this process was not complete prior to the start of the DOE RA, and operators were not aware of some of the PLC software modifications. This situation contributed to the control problems experienced during the DOE RA cold-run demonstration.

These equipment and process problems limited operator cold-run training and required a greater reliance on simulator training. The operators appeared knowledgeable concerning normal operations, and procedures appeared to support verbatim compliance. However, operator knowledge was weak concerning the source of instrument indications and subsystem operation. Additionally, operators appeared to have difficulty in interpreting process indications and responding to unusual conditions. During the DOE RA cold run, operators became distracted by stream temperature control problems and failed to monitor chemical head tanks. As a result, a loss of process stream flow occurred when a chemical head tank was allowed to empty.

The extent of the problems noted during operations caused WSRC to suspend the DOE RA on February 5, 1998. The staff believes WSRC declared readiness even though they had clear indications that the facility was not ready. The DOE RA team did a good job of identifying the facility problems that forced WSRC to suspend the RA; however, DOE-Savannah River (DOE-SR) line management ought to have recognized that the facility was not ready for operations prior to starting the DOE RA.

The Board's staff will continue to monitor DOE-SR and WSRC efforts regarding the DCA controls and use of the PLC interlock. These issues are expected to be resolved prior to facility startup. Additionally, the Board's staff will review WSRC efforts to improve facility readiness to support first-cycle solvent extraction operations beginning May 4, 1998.